Land Use Regression Modeling to Assess Effects of Long-Term Transportation Data on Metabolic Syndrome Risk Factors of Low-Income Communities in El Paso, TX

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Introduction

- Low-income resident's communities with higher pollution levels from traffic-related emissions[1,2,3]
- Strong association of traffic-related emissions with urban air pollution
- Adverse respiratory health effects in near-road communities[4,5,6]
- Fewer studies of long-term exposure to traffic-related pollutants with metabolic factors
- LUR modeling of cardiorespiratory factors with long-term transportation data in El Paso region

1. Brulle & Pellow, 2006
2. Cushing, Morello-Frosch
3. Wander, & Pastor, 2015
4. Barone-Adesi et al., 2015
5. Rhee et al., 2019
6. Downs et al., 2007

Research Objectives

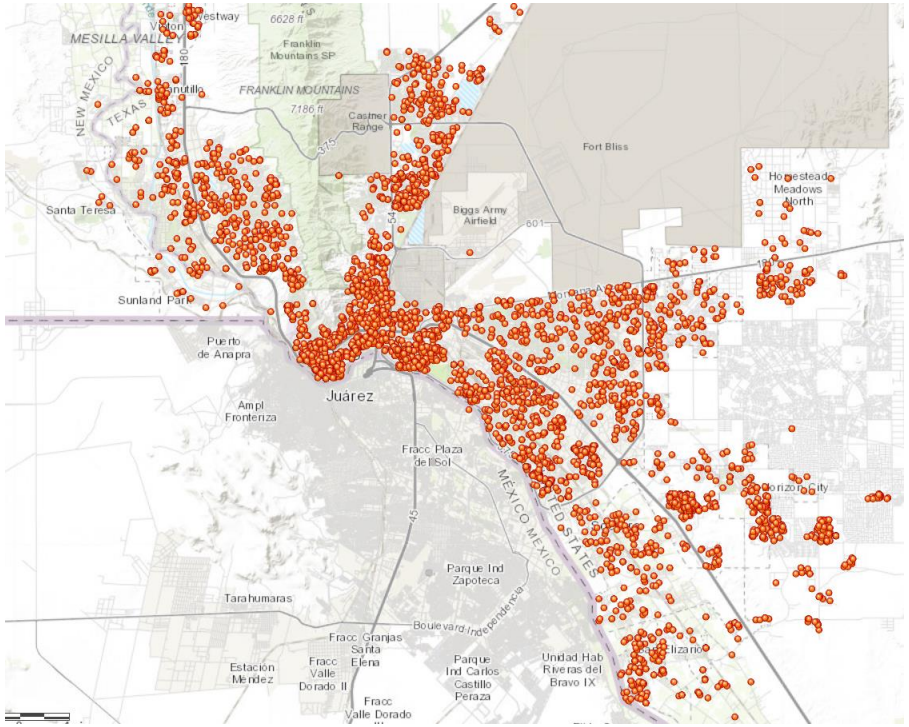
- **Objective 1 (for 1st year data):** Determine the relationships between respiratory health outcomes for lung function and inflammation (exhaled nitric oxide, FVC, FEV_1, and PEF) and the spatially distributed transportation data among a subset of the data.

- **Objective 2 (for 5-year data):** Develop relationships between cardiovascular health outcomes in metabolic factors (waist circumference, blood pressure, triglycerides, HDL-cholesterol, and glucose) and the spatially distributed transportation data. Determine if a classification of metabolic syndrome (MetS) is associated with the transportation variables.

Summary of Study Design

Evidence-based Screening for Obesity, Cardiorespiratory Disease, and Environmental Exposures in Low-income El Paso Households Study

- Study Period: 2014-2020
- About 5,000 of low-income residents in El Paso, TX region.
- Subset Data: Sep. 2014 - May 2015 (N=662 for 1st year data)
- Health measurements: respiratory and cardiovascular health outcomes
- Residential addresses collected to assess long-term air pollution exposure.

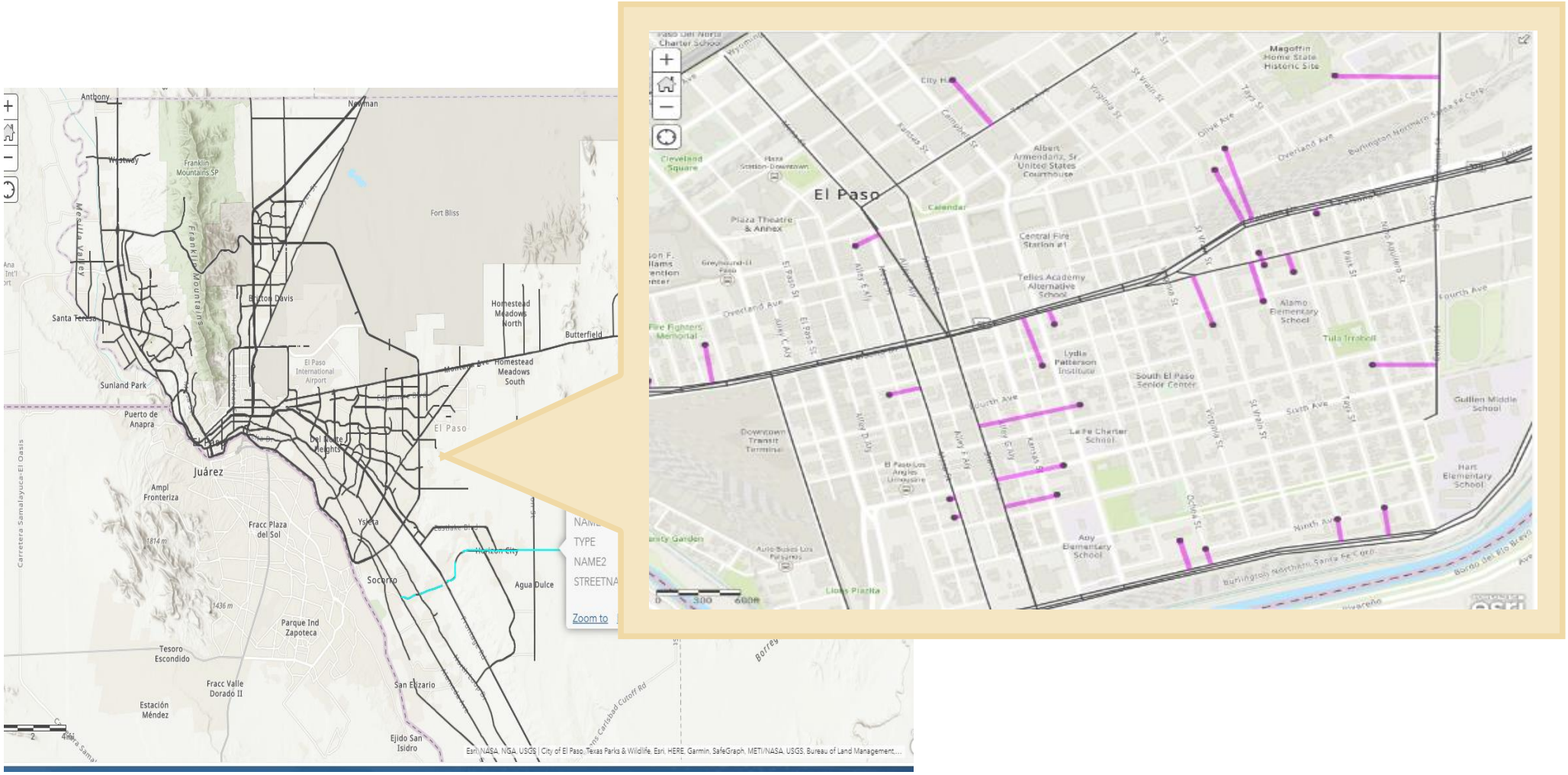


Residential addresses of participants from El Paso, TX

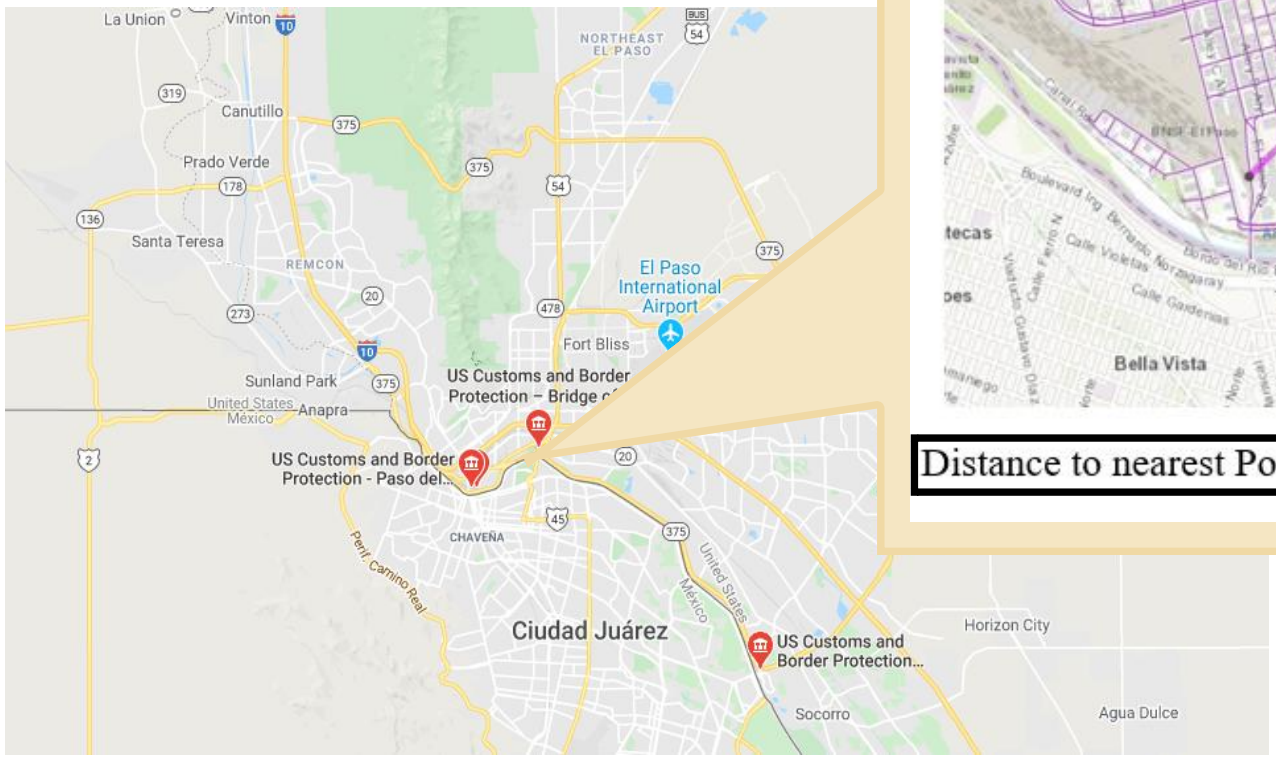
Assessment of Long-term Transportation Predictors

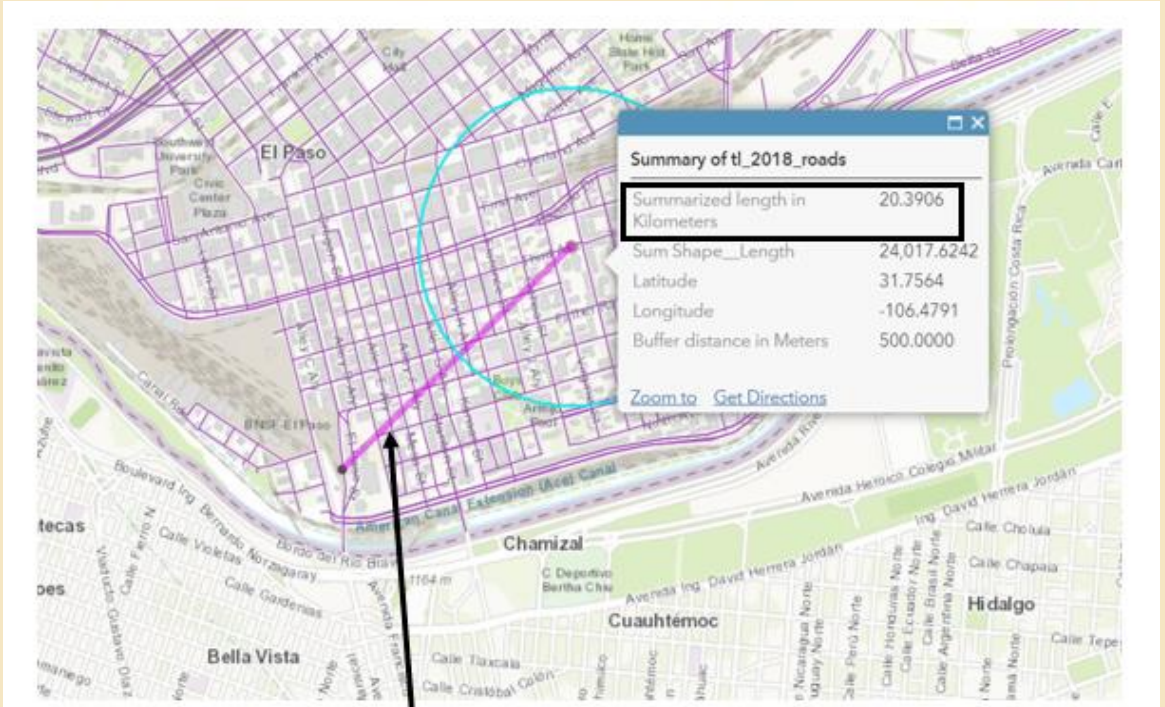
- Major arterial roads
  - *Distance to nearest major arterial road*
- Port of entry (POE)
  - *Distance to nearest POE*
  - *Inverse of the distance to the POE*
  - *Inverse of the distance squared*
- Length of streets
  - *Street length within 500m impact zone*
  - *Street length within 1,000m impact zone*
- Traffic volume
  - *Traffic VMT within 500m impact zone*
  - *Traffic VMT within 1,000m impact zone*

GIS Mapping: Major arterial roads



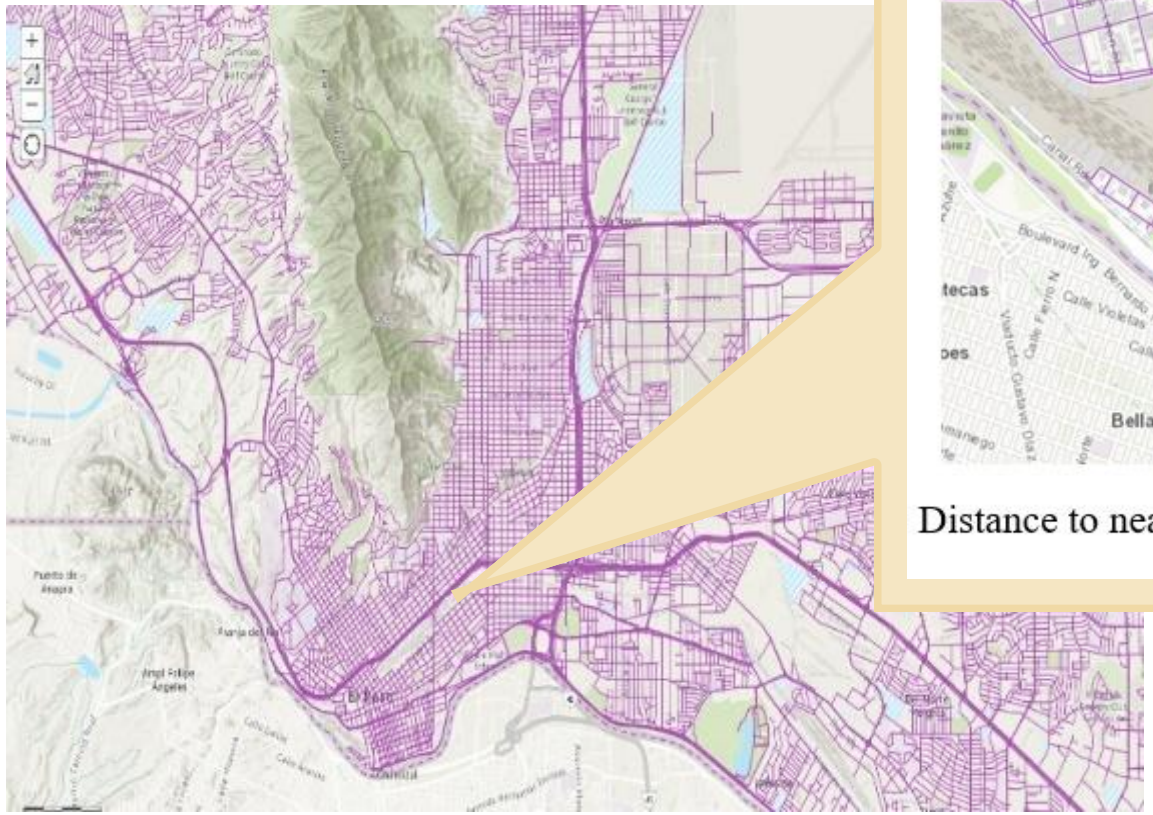
GIS Mapping: Port of Entry

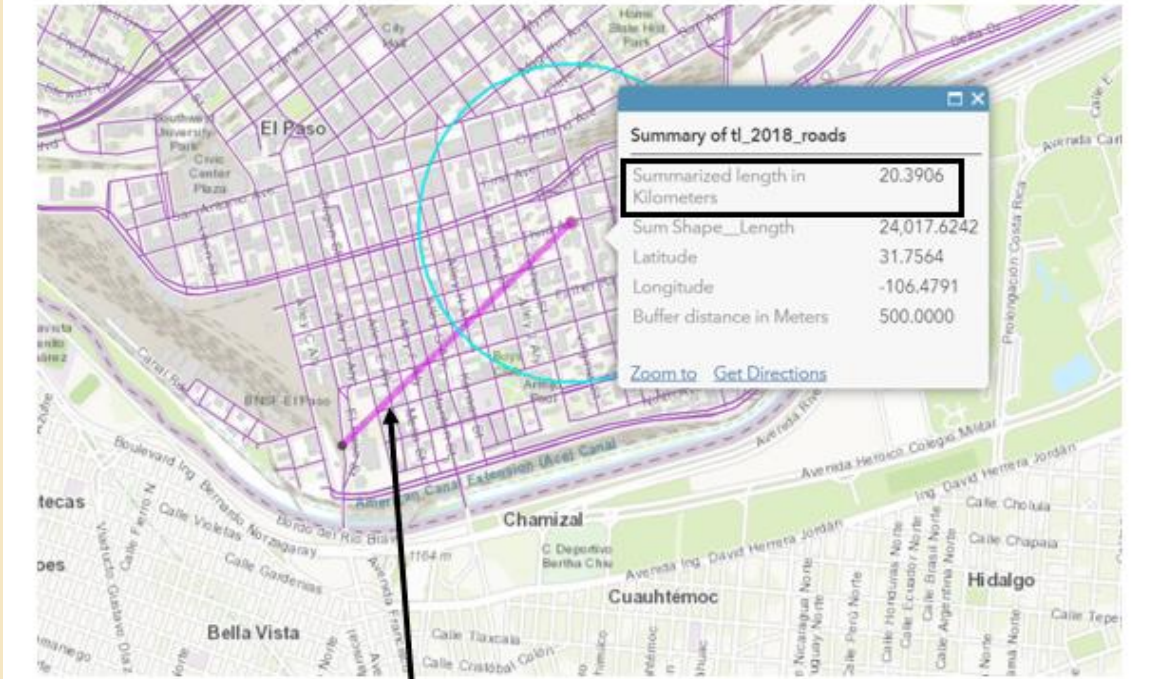




Distance to nearest Port of Entry 500m radius for Total Street Length

GIS Mapping: Street Length



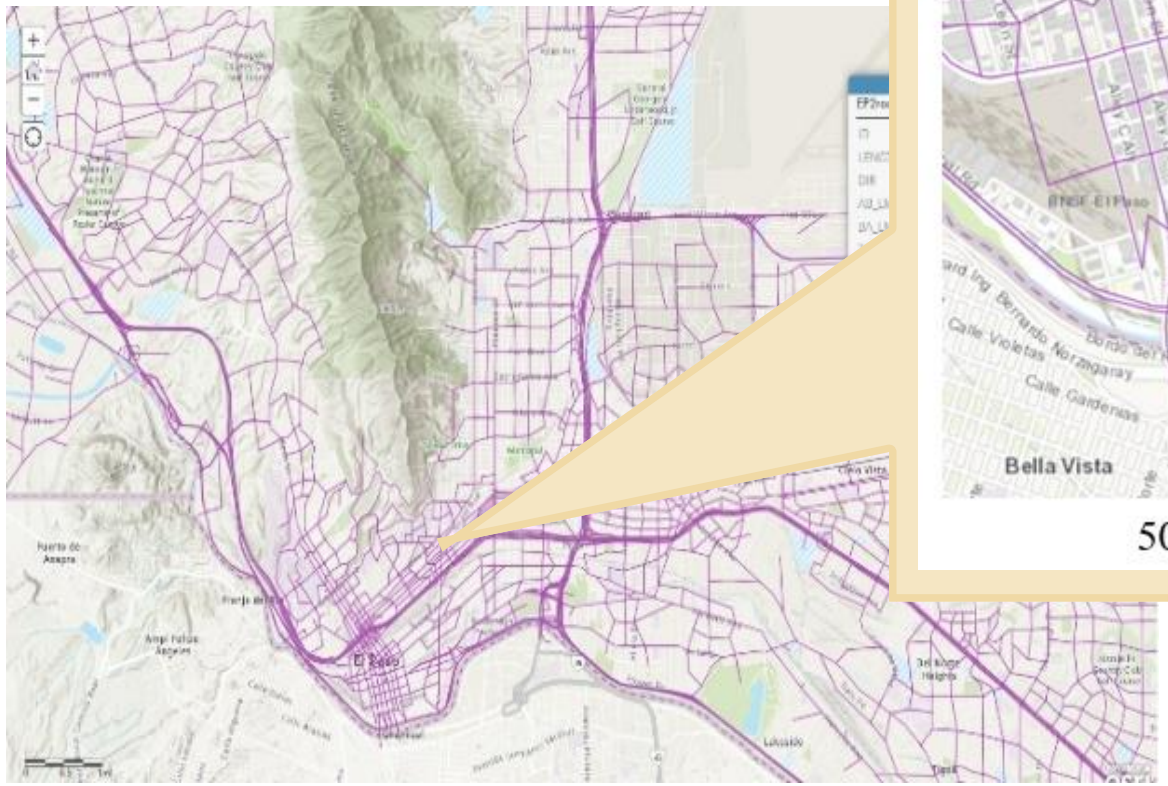


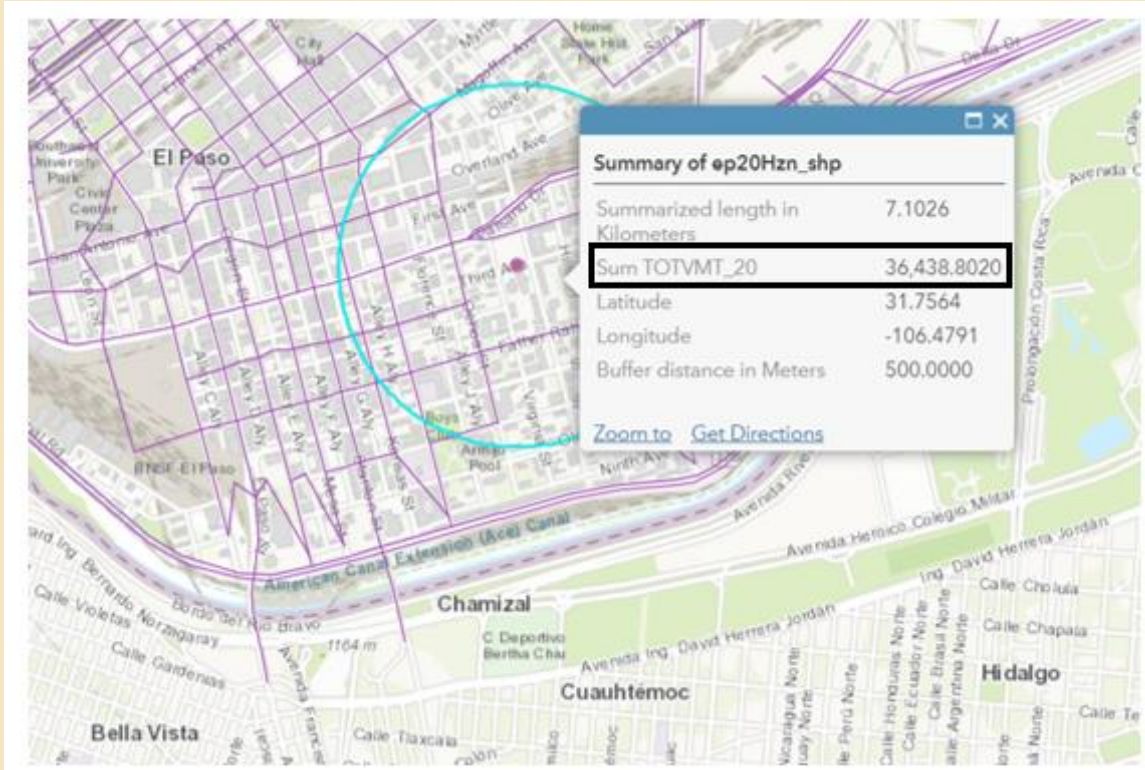
Distance to nearest Port of Entry

500m radius for Total Street Length

Street length from Census.gov

GIS Mapping: Traffic Volume





500m radius for Total Vehicle Miles Traveled

Traffic volume from MPO traffic layer

Respiratory Health Measurements (1st Year Data)

- Lung inflammation
  - *Exhaled nitric oxide (eNO)*
- Lung function measurements
  - *Forced expiratory volume in one second (FEV1), FEV1 %Pred, FEV1 Best*
  - *Forced vital capacity (FVC), FVC %Pred, FVC Best*
  - *Peak expiratory flow (PEF), PEF %Pred, PEF Best*
  - *FEV1/FVC*

NIOXVERO® Airway Inflammation Monitor

MicroDirect MicroLab Spirometer MK8

Metabolic Syndrome Risk Factors (5-Year Data)

- Risk Factors for Metabolic Syndrome
  - *Waistline*
  - *Blood pressure*
  - *HDL-Cholesterol*
  - *Triglyceride level*
  - *Fasting blood glucose*
- At least 3 out of 5 RFs → Metabolic Syndrome

Risk Factor	Cutoff values
Large waistline	≥ 102 cm (≥ 40 inches) in men ≥ 88cm (≥ 35 inches) in women
High blood pressure	≥ 130mmHg systolic or ≥ 85mmHg diastolic
High triglycerides	≥ 150mg/dL
Low HDL-cholesterol	< 40mg/dL in men < 50mg/dL in women
High fasting glucose	≥ 100 mg/dL

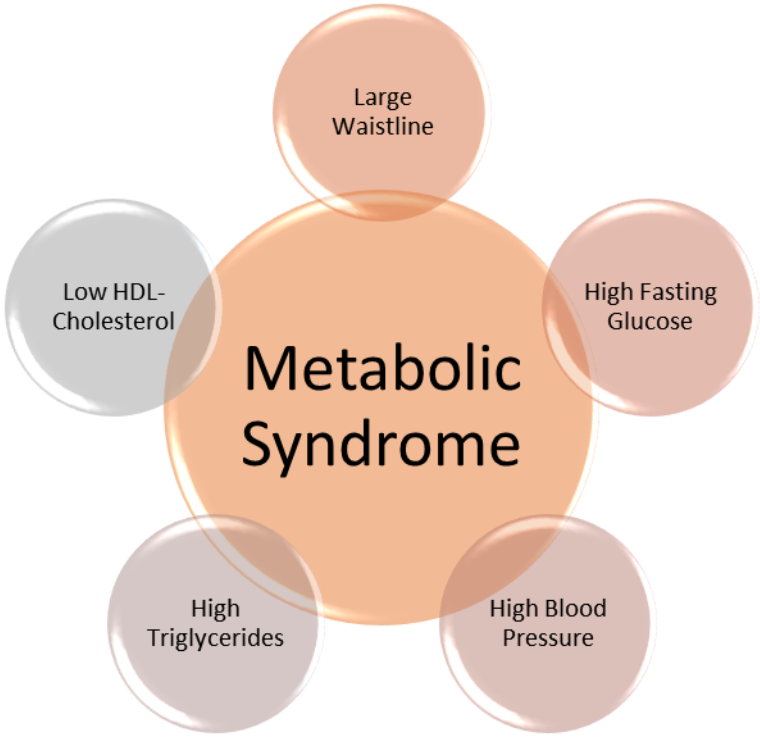


Figure: Rice et al., 2015
Table: Expert Panel on Detection & Treatment of High Blood Cholesterol in, 2001; Grundy, Hansen, Smith, Cleeman, & Kahn, 2004

Statistical Analysis

- Correlation analyses were conducted to establish associations of health outcomes with spatial transportation data.
- Box-Cox transformation was applied to the variables to account for the skewness in the distribution, and different power exponents were selected to transform the data.
- Land Use Regression (LUR) models were used for the respiratory outcomes as well as the cardiovascular outcomes. Stepwise variable selection techniques were applied.
- LUR based on logistic regression analyses were also used to examine the relationships between traffic-related predictors and binary outcomes of cardiovascular risk factors and MetS classification.

1st Year Data: Subject Characteristics

- Female (84%), male (16%)
- Hispanic (98%), Non-Hispanic (1%)
- mean age of 47.8 years old (SD=13.8)
- BMI average = 30.6, range= 12.7-67.7
- Obese (46%), overweight (35%), healthy (15%)

	Mean	SD	Median	Min	Max	IQR	N
Distance nearest Majart	0.24	0.22	0.20	0.00	2.26	0.23	619
Street Length 500m	11.48	3.97	10.96	3.04	24.85	5.70	618
Street Length 1000m	43.60	12.76	44.42	14.09	81.15	16.04	618
Distance nearest POE	6.85	5.12	6.60	0.25	25.36	8.99	619
InvDist POE	0.35	0.42	0.15	0.04	4.05	0.37	619
InvSqDist POE	0.29	1.09	0.02	0.00	16.44	0.21	619
Traffic VMT 500m	26.56	21.99	21.98	0.00	152.94	19.75	619
Traffic VMT 1000m	126.45	85.01	110.53	0.31	412.10	103.06	619

unit: km, in thousands

	Mean	SD	Median	Min	Max	SD	IQR	N
eNO	21.369	14.006	18.000	4.900	113.000	14.006	11.000	501
FEV1	2.399	0.623	2.340	0.755	4.863	0.623	0.742	499
FVC	2.646	0.732	2.553	0.820	6.020	0.732	0.844	499
PEF	5.290	1.688	5.128	1.590	11.477	1.688	2.049	499
FEV1 %Pred	95.872	30.532	92.000	18.00	360.000	30.532	18.000	499
FVC %Pred	84.645	24.289	82.000	16.000	266.000	24.289	18.000	499
PEF %Pred	95.786	26.984	95.000	14.000	267.000	26.984	29.000	499
FEV1/FVC	0.914	0.070	0.920	0.570	1.000	0.070	0.090	499
FEV1 Best	2.509	0.640	2.440	0.420	5.060	0.640	0.690	499
FVC Best	2.768	0.770	2.680	0.450	6.020	0.770	0.900	499
PEF Best	6.107	1.732	6.050	0.800	12.230	1.732	2.005	499

Association of Transportation Parameters and Respiratory Health Outcomes

Table. Correlation between respiratory outcome and traffic variables

	Distance nearest Majart	Street Length 500m	Street Length 1000m	Distance nearest POE	InvDist POE	InvSqDist POE	Traffic VMT 500m	Traffic VMT 1000m
log(eNO)	0.008	0.036	0.003	-0.052	0.025	-0.007	0.034	0.013
FEV_1	0.071	**-0.108**	**-0.108**	0.021	0.010	0.055	**-0.125**	-0.048
FVC	0.072	**-0.090**	**-0.091**	0.047	-0.014	0.032	**-0.116**	-0.051
PEF	**0.090**	**-0.114**	**-0.141**	-0.006	-0.006	0.027	**-0.097**	-0.017
FEV_1 %Pred	0.031	0.010	0.009	**-0.105**	**0.134**	**0.118**	-0.054	0.001
bc.FEV_1 %Pred[1)]	0.040	0.010	0.006	**-0.115**	**0.118**	**0.095**	-0.052	0.006
FVC %Pred	0.041	0.007	0.013	-0.077	**0.101**	**0.093**	-0.066	-0.009
log.FVC %Pred	0.038	0.006	0.012	**-0.082**	**0.088**	0.069	-0.062	-0.002
PEF %Pred	0.047	-0.046	-0.063	**-0.108**	0.075	0.065	-0.060	0.013
sqrt.PEF %Pred	0.053	-0.050	-0.066	-0.112	0.072	0.063	-0.053	0.024
FEV_1/FVC	-0.001	-0.024	-0.033	-0.086	0.066	0.061	-0.019	-0.001
FEV_1 Best	0.048	-0.079	-0.075	0.005	0.025	0.055	**-0.116**	-0.046
FVC Best	0.051	-0.068	-0.060	0.039	-0.006	0.027	**-0.100**	-0.043
PEF Best	0.064	**-0.103**	**-0.127**	-0.016	0.010	0.045	**-0.096**	-0.015

[1)] Box-Cox Transformed FEV_1 %Pred

Association of Transportation Parameters and Respiratory Health Outcomes

Table. Multivariate regression models for respiratory outcomes

Y	Traffic Variables	Estimate	Std. Error	t value	Pr(>|t|)
log(eNO)	(Intercept)	2.913	0.023	128.220	0.000
	Distance_nearest_Majart	0.043	0.139	0.308	0.758
	Street_Length_500m	0.003	0.008	0.368	0.713
	Distance_nearest_POE	-0.005	0.005	-1.124	0.261
	InvSqDist_POE	-0.014	0.022	-0.645	0.519
	Traffic_VMT_500m	0.001	0.001	0.525	0.599
FEV_1	(Intercept)	2.396	0.028	86.197	0.000
	Distance_nearest_Majart	0.110	0.134	0.820	0.413
	Street_Length_500m	-0.017	0.009	-1.843	0.066
	Distance_nearest_POE	-0.000	0.006	-0.014	0.989
	InvSqDist_POE	0.059	0.026	2.302	**0.022**
	Traffic_VMT_500m	-0.002	0.001	-1.584	0.114
FVC	(Intercept)	2.642	0.033	80.533	0.000
	Distance_nearest_Majart	0.147	0.158	0.926	0.355
	Street_Length_500m	-0.012	0.011	-1.074	0.283
	Distance_nearest_POE	0.004	0.007	0.614	0.540
	InvSqDist_POE	0.050	0.030	1.665	0.097
	Traffic_VMT_500m	-0.003	0.002	-1.633	0.103
PEF	(Intercept)	5.279	0.075	69.972	0.000
	Distance_nearest_Majart	0.399	0.364	1.096	0.274
	Street_Length_500m	-0.056	0.025	-2.235	**0.026**
	Distance_nearest_POE	-0.015	0.016	-0.914	0.361
	InvSqDist_POE	0.113	0.070	1.623	0.105
	Traffic_VMT_500m	-0.003	0.004	-0.724	0.470

Y	Traffic Variables	Estimate	Std. Error	t value	Pr(>|t|)
FEV_1 Best	(Intercept)	2.505	0.029	87.041	0.000
	Distance_nearest_Majart	0.064	0.139	0.461	0.645
	Street_Length_500m	-0.012	0.009	-1.269	0.205
	Distance_nearest_POE	-0.001	0.006	-0.166	0.868
	InvSqDist_POE	0.052	0.027	1.964	**0.050**
	Traffic_VMT_500m	-0.003	0.002	-1.765	0.078
FVC Best	(Intercept)	2.762	0.035	79.642	0.000
	Distance_nearest_Majart	0.100	0.167	0.595	0.552
	Street_Length_500m	-0.008	0.011	-0.680	0.497
	Distance_nearest_POE	0.004	0.007	0.570	0.569
	InvSqDist_POE	0.041	0.032	1.289	0.198
	Traffic_VMT_500m	-0.003	0.002	-1.549	0.122
PEF Best	(Intercept)	6.099	0.077	78.796	0.000
	Distance_nearest_Majart	0.220	0.374	0.588	0.557
	Street_Length_500m	-0.057	0.026	-2.241	**0.025**
	Distance_nearest_POE	-0.016	0.016	-0.945	0.345
	InvSqDist_POE	0.137	0.071	1.920	0.055
	Traffic_VMT_500m	-0.004	0.004	-0.868	0.386

5-Year Data: Subject Characteristics

- Female (80%), male (19%)
- 96% of Hispanic
- mean age of 45.5 years old (SD=14.9, range=18-94)
- BMI average = 29.9, range= 15.3-67.7
- Obese (31%), overweight (24%), healthy (14%)

	Mean	SD	Median	Min	Max	IQR	NA
Distance_nearest_Majart	0.33	0.34	0.22	0.00	3.35	0.32	152
Street_Length_500m	10.73	4.23	10.23	0.28	25.51	5.34	174
Street_Length_1000m	39.20	15.40	36.95	0.20	83.04	19.41	168
Distance_nearest_POE	9.48	7.00	8.62	0.16	37.58	10.42	152
InvDist_POE.km	0.28	0.46	0.12	0.03	6.15	0.22	152
InvSqDist_POE.km	0.29	1.70	0.01	0.00	37.78	0.08	152
Traffic_VMT_500m	23.34	27.47	15.49	0.00	178.54	20.77	319
Traffic_VMT_1000m	102.38	100.86	65.65	0.17	437.44	102.52	176

Variables		Frequency	%
HighWaist	1	2307	46.5
	0	1603	32.3
	NA	1049	21.2
HighBP	1	1622	32.7
	0	2561	51.6
	NA	776	15.6
HighTC	1	1363	27.5
	0	2247	45.3
	NA	1349	27.2
HighTRG	1	2047	41.3
	0	1588	32.0
	NA	1324	26.7
LowHDL	1	1835	37.0
	0	1750	35.3
	NA	1374	27.7
HighGLU	1	1795	36.2
	0	1827	36.8
	NA	1337	27.0
MetS	1	1851	37.3
	0	1626	32.8
	NA	1482	29.9

Association of Traffic-related Variable and Metabolic Syndrome Risk Factors

Correlation between metabolic syndrome risk factor and traffic variables

	Distance nearest Majart	Street Length 500m	Street Length 1000m	Distance nearest POE	InvDist POE	InvSqDist POE	Traffic VMT 500m	Traffic VMT 1000m
BMICalc	0.022	0.005	-0.010	**0.039**	-0.002	0.000	**-0.043**	**-0.042**
WAIST	-0.001	**0.045**	0.031	-0.002	**0.046**	**0.033**	0.002	0.006
Female	-0.004	**0.059**	**0.046**	-0.009	**0.054**	0.024	0.013	0.017
Male	0.045	-0.018	-0.054	0.065	-0.001	0.028	-0.050	-0.062
SBP1	0.012	0.008	0.018	**-0.031**	0.018	0.013	0.028	0.021
SBP1 < 130	**0.041**	-0.021	-0.015	0.029	-0.011	0.012	0.006	-0.007
SBP1 >= 130	0.031	-0.001	-0.001	-0.022	0.033	0.031	0.041	0.020
DBP1	0.022	-0.029	**-0.032**	0.020	-0.020	-0.006	-0.016	**-0.033**
DBP1 < 85	0.021	-0.025	-0.025	0.027	**-0.040**	-0.022	0.010	-0.020
DBP1 >= 85	-0.033	0.030	0.009	0.008	0.013	-0.010	-0.004	-0.018
PBP	-0.002	**0.035**	**0.050**	**-0.059**	**0.040**	0.023	**0.051**	**0.055**
TC1	**0.036**	-0.026	**-0.040**	0.022	-0.015	0.002	-0.012	-0.031
TRG1	0.012	0.028	0.006	-0.010	0.023	0.017	0.014	-0.019
log.TRG1	0.013	**0.035**	0.009	-0.007	0.025	0.019	0.011	-0.027
HDL1	0.016	**-0.046**	**-0.046**	0.001	**-0.041**	-0.027	-0.025	-0.021
LDL1	0.023	-0.026	-0.032	0.026	-0.024	-0.007	-0.011	-0.020
TC/HDL1	0.013	0.011	0.000	0.012	0.013	0.018	0.021	-0.003
log.TC/HDL1	0.011	0.019	0.009	0.010	0.020	0.024	0.021	-0.003
bc.TC/HDL1[2)]	0.010	0.021	0.013	0.010	0.022	0.025	0.020	-0.004
GLU1	0.003	0.032	0.021	**-0.036**	**0.064**	**0.051**	0.018	0.006
log.GLU1	0.001	**0.037**	0.023	**-0.035**	**0.066**	**0.049**	0.017	0.004
bc.GLU1[3)]	0.001	**0.043**	0.025	-0.031	**0.061**	**0.040**	0.016	0.001

[2),3)] Box-Cox Transformed TC/HDL1 and GLU1

Association of Traffic-related Variable and Metabolic Syndrome Risk Factors

Table. Multivariate regression models for MetS risk factors

Y	Traffic Variables	Estimate	Std. Error	t value	P-value
WAIST	(Intercept)	93.875	0.241	389.725	0.000
	Distance_nearest_Majart	0.462	0.878	0.526	0.599
	Street_Length_500m	0.294	0.077	3.793	**0.000**
	Distance_nearest_POE	0.054	0.041	1.329	0.184
	InvSqDist_POE.km	0.176	0.140	1.255	0.210
	Traffic_VMT_500m	-0.020	0.011	-1.801	0.072
WAIST (Female, N=3941)	(Intercept)	92.889	0.267	347.822	0.000
	Distance_nearest_Majart	0.322	0.953	0.338	0.736
	Street_Length_500m	0.351	0.086	4.097	**0.000**
	Distance_nearest_POE	0.049	0.045	1.099	0.272
	InvSqDist_POE.km	0.053	0.196	0.269	0.788
	Traffic_VMT_500m	-0.019	0.012	-1.548	0.122
SBP1	(Intercept)	123.202	0.308	399.361	0.000
	Distance_nearest_Majart	1.804	1.122	1.608	0.108
	Street_Length_500m	-0.054	0.099	-0.542	0.588
	Distance_nearest_POE	-0.084	0.052	-1.610	0.107
	InvSqDist_POE.km	0.110	0.183	0.600	0.549
	Traffic_VMT_500m	0.021	0.014	1.518	0.129
DBP1	(Intercept)	76.386	0.183	417.888	0.000
	Distance_nearest_Majart	0.445	0.665	0.669	0.503
	Street_Length_500m	-0.053	0.059	-0.897	0.370
	Distance_nearest_POE	0.011	0.031	0.360	0.719
	InvSqDist_POE.km	0.013	0.108	0.120	0.905
	Traffic_VMT_500m	0.001	0.008	0.108	0.914
PBP	(Intercept)	46.816	0.227	206.456	0.000
	Distance_nearest_Majart	1.359	0.825	1.648	0.099
	Street_Length_500m	-0.001	0.073	-0.014	0.989
	Distance_nearest_POE	-0.095	0.038	-2.481	**0.013**
	InvSqDist_POE.km	0.097	0.135	0.720	0.472
	Traffic_VMT_500m	0.021	0.010	1.978	**0.048**

Y	Traffic Variables	Estimate	Std. Error	t value	P-value
TRG1	(Intercept)	187.067	1.867	100.215	0.000
	Distance_nearest_Majart	12.724	6.868	1.853	0.064
	Street_Length_500m	0.901	0.603	1.494	0.135
	Distance_nearest_POE	0.094	0.319	0.295	0.768
	InvSqDist_POE.km	0.730	1.055	0.692	0.489
	Traffic_VMT_500m	0.026	0.085	0.312	0.755
log.TRG1	(Intercept)	5.078	0.010	528.973	0.000
	Distance_nearest_Majart	0.068	0.035	1.917	0.055
	Street_Length_500m	0.007	0.003	2.236	**0.025**
	Distance_nearest_POE	0.001	0.002	0.636	0.525
	InvSqDist_POE.km	0.004	0.005	0.734	0.463
	Traffic_VMT_500m	0.000	0.000	-0.151	0.880
HDL1	(Intercept)	48.563	0.263	184.810	0.000
	Distance_nearest_Majart	-0.220	0.971	-0.227	0.821
	Street_Length_500m	-0.222	0.085	-2.616	**0.009**
	Distance_nearest_POE	-0.059	0.045	-1.318	0.188
	InvSqDist_POE.km	-0.151	0.148	-1.024	0.306
	Traffic_VMT_500m	0.000	0.012	0.002	0.998
GLU1	(Intercept)	113.656	0.841	135.214	0.000
	Distance_nearest_Majart	3.365	3.096	1.087	0.277
	Street_Length_500m	0.261	0.271	0.962	0.336
	Distance_nearest_POE	-0.200	0.144	-1.395	0.163
	InvSqDist_POE.km	1.156	0.474	2.438	**0.015**
	Traffic_VMT_500m	-0.005	0.038	-0.143	0.886
log.GLU1	(Intercept)	4.678	0.005	908.585	0.000
	Distance_nearest_Majart	0.019	0.019	1.027	0.305
	Street_Length_500m	0.002	0.002	1.395	0.163
	Distance_nearest_POE	-0.001	0.001	-1.161	0.246
	InvSqDist_POE.km	0.007	0.003	2.279	**0.023**
	Traffic_VMT_500m	0.000	0.000	-0.368	0.713

Association of Traffic-related Variable and Metabolic Syndrome Classification

Table. Multivariate logistic regression models for MetS risk

Y	Traffic Variables	Estimate	P-value	Odds Ratio	Lower 95% CI	Upper 95% CI
HighWaist	(Intercept)	0.359	0.000	1.431	1.340	1.529
	Distance_nearest_Majart	-0.037	0.763	0.964	0.758	1.227
	Street_Length_500m	**0.034**	**0.002**	**1.035**	**1.013**	**1.058**
	Distance_nearest_POE	0.016	**0.007**	**1.016**	**1.004**	**1.027**
	InvSqDist_POE.km	-0.006	0.771	0.994	0.957	1.034
	Traffic_VMT_500m	-0.002	0.185	0.998	0.995	1.001
HighBP	(Intercept)	-0.459	0.000	0.632	0.592	0.674
	Distance_nearest_Majart	0.106	0.376	1.112	0.879	1.403
	Street_Length_500m	0.000	0.998	1.000	0.979	1.021
	Distance_nearest_POE	-0.010	0.072	0.990	0.979	1.001
	InvSqDist_POE.km	-0.006	0.756	0.994	0.954	1.032
	Traffic_VMT_500m	0.000	0.894	1.000	0.997	1.003
HighTC	(Intercept)	-0.515	0.000	0.598	0.557	0.641
	Distance_nearest_Majart	-0.009	0.947	0.991	0.766	1.280
	Street_Length_500m	-0.013	0.265	0.987	0.965	1.010
	Distance_nearest_POE	0.003	0.671	1.003	0.991	1.015
	InvSqDist_POE.km	0.028	0.157	1.028	0.989	1.070
	Traffic_VMT_500m	0.000	0.760	1.000	0.997	1.004
HighTRG	(Intercept)	0.253	0.000	1.288	1.203	1.379
	Distance_nearest_Majart	0.146	0.256	1.157	0.901	1.491
	Street_Length_500m	**0.024**	**0.034**	**1.024**	**1.002**	**1.047**
	Distance_nearest_POE	0.005	0.381	1.005	0.994	1.017
	InvSqDist_POE.km	-0.001	0.951	0.999	0.961	1.039
	Traffic_VMT_500m	-0.001	0.446	0.999	0.996	1.002

Y	Traffic Variables	Estimate	P-value	Odds Ratio	Lower 95% CI	Upper 95% CI
LowHDL	(Intercept)	0.049	0.162	1.050	0.981	1.124
	Distance_nearest_Majart	0.129	0.314	1.138	0.885	1.464
	Street_Length_500m	**0.032**	**0.004**	**1.033**	**1.010**	**1.056**
	Distance_nearest_POE	0.010	0.100	1.010	0.998	1.022
	InvSqDist_POE.km	0.028	0.187	1.028	0.988	1.075
	Traffic_VMT_500m	0.000	0.969	1.000	0.997	1.003
HighGLU	(Intercept)	-0.013	0.710	0.987	0.923	1.056
	Distance_nearest_Majart	0.095	0.457	1.099	0.857	1.412
	Street_Length_500m	0.009	0.434	1.009	0.987	1.031
	Distance_nearest_POE	0.009	0.136	1.009	0.997	1.021
	InvSqDist_POE.km	0.028	0.170	1.028	0.989	1.073
	Traffic_VMT_500m	0.000	0.906	1.000	0.997	1.003
MetS	(Intercept)	0.127	0.000	1.135	1.059	1.216
	Distance_nearest_Majart	0.022	0.866	1.022	0.793	1.319
	Street_Length_500m	**0.038**	**0.001**	**1.039**	**1.016**	**1.062**
	Distance_nearest_POE	0.009	0.118	1.009	0.998	1.022
	InvSqDist_POE.km	0.006	0.777	1.006	0.968	1.047
	Traffic_VMT_500m	-0.002	0.124	0.998	0.994	1.001

Predicted Probability of Metabolic Syndrome

Logistic Regression Formula including three selected traffic variables for MetS:

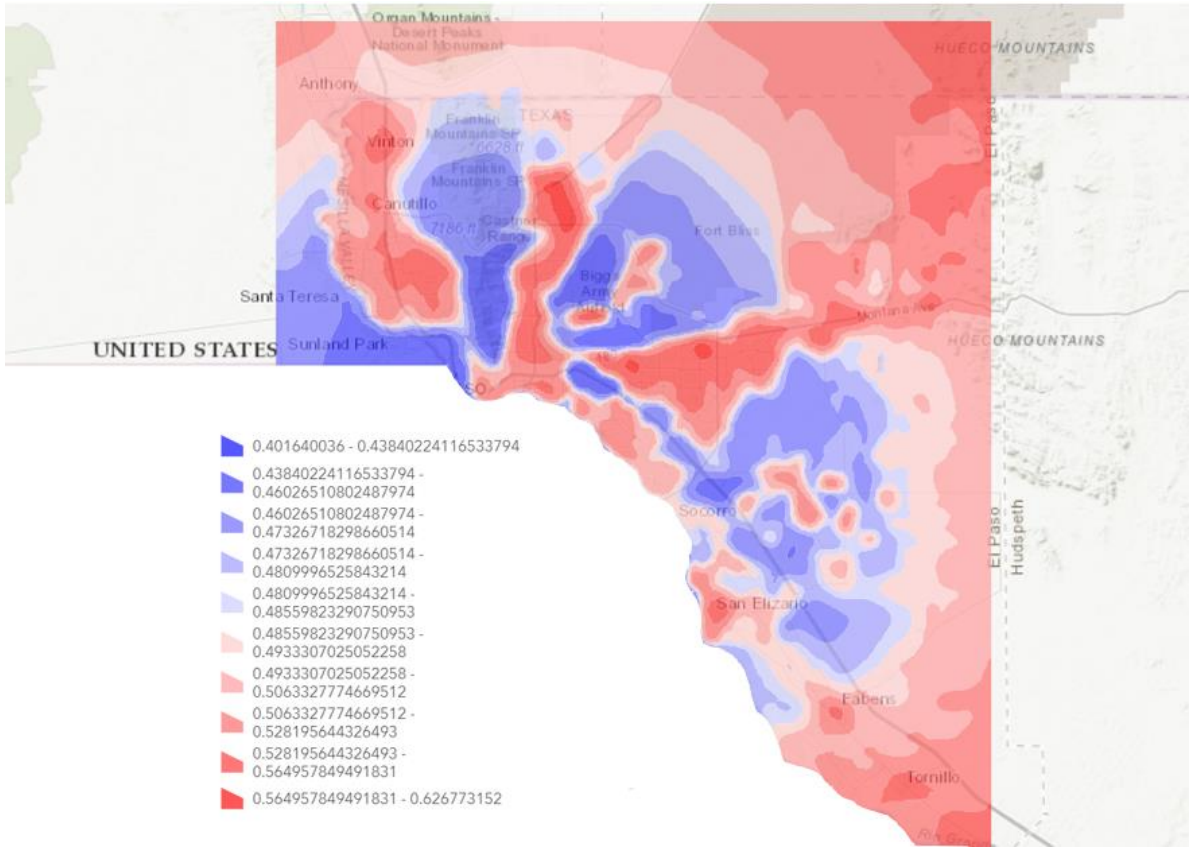
$$\ln\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 \cdot Centered(Street\ Length\ within\ 500m)$$
$$+ \beta_2 \cdot Centered(Distance\ to\ the\ nearest\ POE)$$
$$+ \beta_3 \cdot Centered(Traffic\ VMT\ within\ 500m),$$

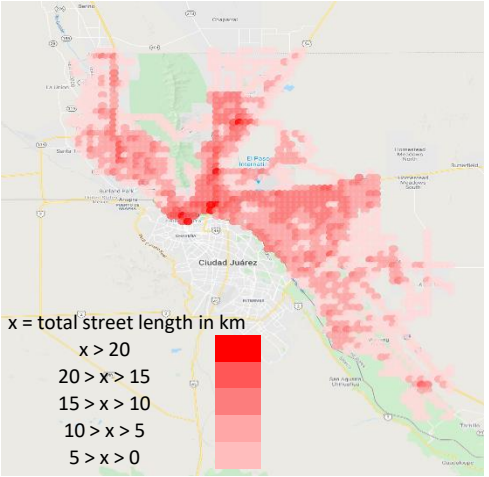
where $p = P(\text{Metabolic Syndrome} = 1)$.

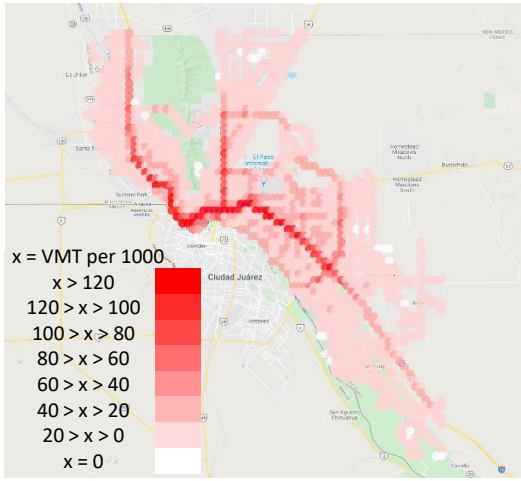
To calculate the probability of MetS, we use estimates from the multivariate logistic regression fitting:

$$\widehat{\beta_0} = 0.126, \widehat{\beta_1} = 0.038, \widehat{\beta_2} = 0.009, \widehat{\beta_3} = -0.003$$

Predicted Probability of Metabolic Syndrome







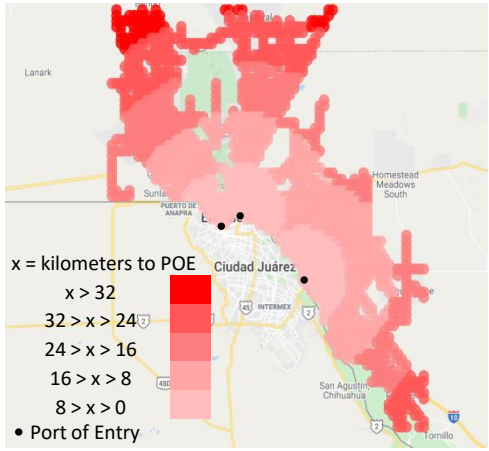


Figure. Map of predicted probability of MetS based on the LUR model including three selected variables.

Summary

- Length of street predicted lung function: PEF, PEF Best
- Traffic volume and proximity to POE related to PBP
- Length of street associated with MetS risk factors: waistline, triglycerides, HDL-cholesterol
- Length of street predicted high risks in MetS risk factors: large waistline, high triglycerides, low HDL-cholesterol
- Prediction of metabolic syndrome related to street length

Discussion

- Variation on outdoor/ambient vs. indoor pollution
- Long-term exposures rely on available layers: MPO, Census, and PDNMAPA
- Analysis does not include the traffic effects from Ciudad Juárez in Mexico
- Modeling improvement by adding subject's demographic information

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Thank You!